

$$\text{CFSE Value} = \frac{\text{No. of orbitals in opposite side} \times 10 Dq}{\text{Total no. of orbitals}}$$

example for e_g CFSE = $\frac{3 \times 10 Dq}{5} = 6 Dq$

example for t_{2g} CFSE = $\frac{-2 \times 10 Dq}{5} = -4 Dq$

Splitting of d-orbital in tetrahedral field :-

When ligand approach towards d-orbital then split into two set of orbitals one in e and other in t_2 .

⇒ Here, doesn't use g because tetrahedral is less symmetrical than octahedral.

⇒ e -set of orbital having less energy and migrate downward from bary centre (zero energy level) and t_2 set of orbital having migrate upward from bary centre because having more energy.

CFSE - (Crystal field stabilization energy)

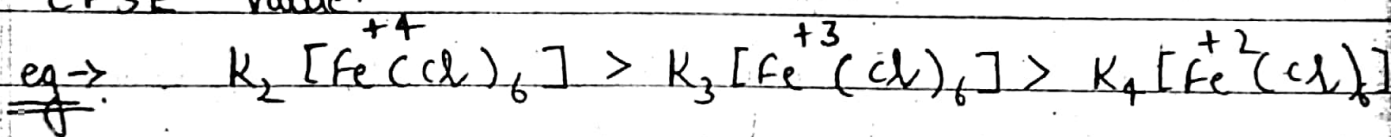
The amount of energy which stabilised complex compound.

When CFSE Value $\uparrow$ then $\uparrow$ stability of complex compound $\downarrow$ reactivity of complex compound.

Factors effecting Value of CFSE -

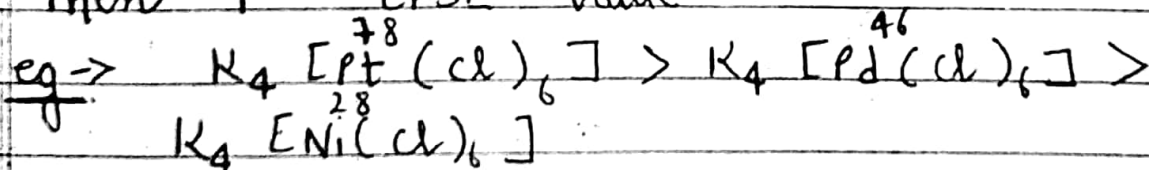
i) Oxidation No. -

When oxidation no. of central atom (metal of d and f block) $\uparrow$ then $\uparrow$ CFSE Value.



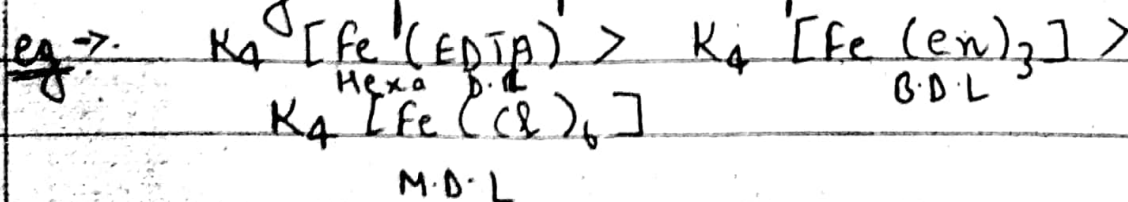
ii) Size of metal -

When size of metal (d & f-block) $\uparrow$ then $\uparrow$ CFSE Value.



iii) Chelating effect -

When ring form tendency $\uparrow$ then $\uparrow$ stability of complex compound.



Chelating ligand - ligand having density equal or greater than 3.

eg $\rightarrow$ EDTA, en, C_2O_4 (oxalate)

$\Rightarrow$ Calculation of CFSE in Octahedral field -

$$\text{CFSE in octahedral} = +0.4 e_g n \pm 0.6 t_{2g} n + mp$$

$$\text{CFSE in tetrahedral} = +0.6 t_{2n} \pm 0.4 e_n + mp$$

where,

$e_g n$ = No. of e^- in e_g set of orbital

$t_{2g} n$ = No. of e^- in t_{2g} set of orbital

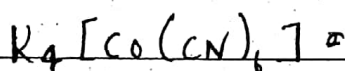
t_{2n} = No. of e^- in t - set of orbital

e_n = No. of e^- in e - set of orbital

m = No. of e^- in paired orbital

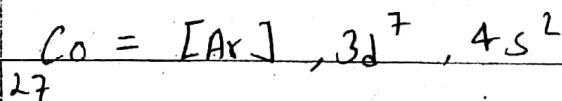
p = pairing energy.

Q Find CFSE of $K_4[Co(CN)_6]$ having pairing energy 7 KJ.



$$4 + x - 6 = 0$$

$$x = 2$$



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